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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,855	04/09/2004	Min-Lung Huang	HUAN3262/EM	8687
23364 7590 08/27/2007 BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314				
EXAMINER				
KALAM, ABUL				
ART UNIT		PAPER NUMBER		
2814				
MAIL DATE		DELIVERY MODE		
08/27/2007		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/820,855

Applicant(s)

HUANG, MIN-LUNG

Examiner

Abul Kalam

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 February 2007 and 23 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-12, 15-18 and 20-24 is/are pending in the application.
- 4a) Of the above claim(s) 8-12, 15-18 and 20-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6 and 7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-848)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species I, to which claims 1-4, 6 and 7 are readable, in the reply filed on May 23, 2007, is acknowledged. Claims 8-12, 15-18 and 20-24 read on the non-elected species, and thus are withdrawn from further consideration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-4, 6 and 7** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Applicant's Admitted Prior Art (AAPA)** in view of **Andricacos et al. (US 6,224,690; previously cited)**.

With respect to **claim 1**, **AAPA** teaches (**pg. 2: [0004]-[0005]**) an under bump metallization structure (**FIG. 1**) applicable to be disposed on bonding pads (**104**) of a semiconductor wafer (**101**), wherein a passivation layer (**102**) covers the wafer and exposes the bonding pads (**104**), the under bump metallization structure (**106**) comprising:

an adhesive layer (**106a**) formed on the bonding pads (**104**);

a first barrier layer (**106b**) disposed on the adhesive layer (**106a**); and

a wetting layer formed **(106c)** on the first barrier layer **(106b)**.

Thus, **AAPA** teaches all the limitations of the claim with the exception of disclosing: a second barrier layer disposed on the wetting layer wherein a material of the second barrier comprises tin and nickel.

However, **Andricacos** teaches a under bump metallization structure **(FIG. 4)**, wherein a second barrier layer of nickel-tin intermetallic **(col. 5: Ins. 26-32)** is disposed on the wetting layer **(Cu)**.

With respect to **claim 2**, **Andricacos** teaches wherein the quantity of the tin is smaller than the quantity of the nickel **(this is implicit because Andricacos states that although a nickel-tin intermetallic is formed, the under bump metallization does not spall off; col. 5: Ins. 26-32)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of **AAPA** with the teaching of **Andricacos**, to form a barrier layer on the wetting layer of copper, for the purpose of preventing the reaction of the solder with the underlying copper, and thus preventing the spalling of the under bump metallization layer **(col. 5: Ins. 26-32)**.

With respect to **claim 3**, **AAPA and Andricacos** teaches the under bump metallization structure of claim 1, as set forth above. Furthermore, **AAPA** teaches wherein the first barrier layer comprises nickel-vanadium or nickel **(pg. 2: [0005])**.

With respect to **claim 4**, **AAPA and Andricacos** teaches the under bump metallization structure of claim 1, as set forth above. Furthermore, **AAPA** teaches wherein the wetting layer is a copper layer **(pg. 2: [0005])**.

With respect to **claim 6, AAPA and Andricacos** teaches the under bump metallization structure of claim 1, as set forth above. Furthermore, **AAPA** teaches wherein the adhesive layer comprises titanium (**pg. 2: [0005]**).

With respect to **claim 7, AAPA and Andricacos** teaches all the limitations of the claim, as set forth above in claim 1, with exception of explicitly disclosing: wherein the thickness of the second barrier layer is ranged from about 50 μm to about 80 μm .

However, note that it is not inventive to discover optimal or workable ranges by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Furthermore, where patentability is based upon a particular chosen range or dimension recited in the claim, the Applicant must show that the chosen range or dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have a thickness of the second barrier layer in such a range as claimed, because the range is not critical since it can be optimized during routine experimentation, depending upon the desired conductivity the second barrier layer.

Response to Arguments

3. Applicant's arguments with respect to claims 1-4, 6 and 7, filed February 16, 2007, have been considered but are not persuasive.

With respect to claim 1, Applicant argues that "Andricacos does not disclose a second barrier layer comprising tin and nickel, but rather discloses a second barrier

layer of nickel only.” These is not persuasive, because Andricacos clearly states (col. 5: Ins. 28-31) that “Although a nickel-tin intermetallic is formed, it does not spall off or lose adhesion at the copper-nickel interface. Further, **it prevents the reaction of the solder with the underlying copper.**” Applicant also seems to be arguing that the nickel-tin layer is only formed after the nickel has served as a barrier layer. This is an incorrect interpretation of the reference, since Andricacos clearly states that the nickel-tin layer **“prevents the reaction of the solder with the underlying copper,”** and thus acts as a barrier between the copper and the solder.

Applicant also argues that “the motivation statement provided in the Official Action is not correct” and that “Andricacos provides no such teaching.” This argument is not persuasive because Andricacos clearly states (col. 5: Ins. 28-31) that “Although a nickel-tin intermetallic is formed, **it does not spall off or lose adhesion at the copper-nickel interface.** Further, **it prevents the reaction of the solder with the underlying copper.**” Furthermore, note that Applicant does not specifically address the motivation provided in the Office Action, such as “preventing the spalling of the under bump metallization layer.”

With respect to claim 2, Applicant challenges the Office's position that the nickel-tin intermetallic of Andricacos, implicitly has a higher quantity of nickel than tin, because Andricacos states that although a nickel-tin intermetallic is formed, the under bump metallization does not spall off (col. 5: Ins. 28-29). Support for the Office's position is found in column 3, lines 5-10 of Liu et al. (US 6,744,142; previously cited).

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abul Kalam whose telephone number is 571-272-8346.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2814

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AK

/Thao X Le/

Primary Examiner, Art Unit 2814